Spenders versus savers: climate-induced carbon allocation tradeoffs in a recently introduced woody plant

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Abstract

Non-structural carbohydrate (NSC) storage may be under strong selection in woody plant species that occur across strong environmental gradients. We therefore investigated carbon allocation strategies in a widely distributed, introduced woody plant. We predicted genotypes from cold climates with exposure to episodic freeze events, would have elevated NSC concentrations with the tradeoff of reduced growth and reproduction relative to warm-adapted genotypes. We

established an experimental common garden using genotypes of *Tamarix spp.,* sourced across a large thermal gradient within their introduced range. We measured seasonal NSC storage in coarse roots and stems, above-ground growth and flower production. Autumn NSC concentrations were 50% higher in genotypes from sites with spring freeze events compared to genotypes from warmer sites. Cold-adapted genotypes also had a 2.3-fold higher starch to soluble sugar ratio than warm-adapted genotypes. Across all genotypes and seasons, NSC storage was inversely correlated with growth and reproduction. Results suggest that *Tamarix* from colder locations cope with freeze events by maintaining large storage pools to support tissue regrowth, but with the tradeoff of reduced growth and reproduction. Results provide evidence of selection in carbon allocation strategies in response to climate in introduced woody species.

Keywords: *Tamarix chinensis X ramosissima* (Saltcedar), non-structural carbohydrates, frost tolerance, plant starch concentrations, experimental common garden

Author contribution

KG, SB, TD, CD, KH designed the common garden. RL and KH designed the study. RL collected and analyzed the samples and data. RL wrote the manuscript, and all authors contributed to the revisions.